Field Evaluation of Underground Storage Tank Leak Detection Sensors Report – August, 2002
Recommendations and California's UST Program Status

The recommendations in this table have been copied directly from the "Recommendations" section of the Field Evaluation of Underground Storage Tank Leak Detection Sensors Report. They are designed to improve the effectiveness of sensors as a leak detection method by addressing specific issues observed during this field evaluation. The "action" column of this table describes what the SWRCB and UST program staff has done (or are planning to do) to address the corresponding recommendation.

Recommendations are organized into six categories: *Sensor Design and Performance*, *Secondary Containment Performance and Compliance Issues, Oversight and Qualifications, Sensor Field-Certification and Testing Procedures, Maintenance and Programming,* and *Discriminating Sensors.* The *Sensor Design and Performance* section contains recommendations applicable to all sensors, while issues pertaining specifically to discriminating sensors have been included as a separate section for easy reference.

	RECOMMENDATION	ACTION
Sensor Design and Performance		
1	**Improvement in the design and manufacture of sensors is needed.** The results of this field evaluation indicate that the environment in which UST leak detection sensors operate can degrade their performance over time. Manufacturers should design sensor housings, wiring, and functional elements to endure UST system conditions for the anticipated life of the sensor.	SWRCB UST program staff have worked with manufacturers in the past, and will continue to do so in order to improve the effectiveness of sensors.
2	**Float switch sensor design should allow for free movement of the float.** For a float switch sensor to operate effectively, the float must be free to move up and down in response to the presence of liquid in the secondary containment. Manufacturers should produce float switch sensors that are not easily obstructed by dirt and debris, or are in an enclosed housing that keeps debris away from the float mechanism.	SWRCB UST program staff have worked with manufacturers in the past, and will continue to do so in order to improve the effectiveness of sensors.
3	**All sensors should be evaluated under field-representative conditions.** Standard EPA evaluation protocols should be re-evaluated by a workgroup of inspectors, manufacturers, and third-party evaluators. Modifications to the protocols should be made to assure that the evaluation challenges the sensor's performance under conditions likely to be encountered in the field. Once the new protocol is in place, only sensors that have been evaluated by an independent third party in accordance with the revised protocol should be approved for new installations.	SWRCB UST program staff have worked with the National Workgroup on Leak Detection Evaluation (NWGLDE), which reviews third-party evaluations of leak detection equipment. We will continue to work with the NWGLDE, USEPA, and other state UST programs to improve the evaluation process.
4	**Sensors should not be used as the sole method of leak detection for double-walled pressurized piping.** This field evaluation has shown that, for a variety of reasons, sensors may fail to detect a release from the primary containment. Therefore, a line leak detector or other leak detection should be used as a backup. This will reduce the risk of release to the environment in the event of a catastrophic failure of the primary piping.	In response to this recommendation, as well as a similar recommendation issued by the American Petroleum Institute, SWRCB UST program staff have drafted a proposed regulatory change requiring automatic line leak detectors on all pressurized piping.

Secondary Containment Performance and Compliance Issues		
1	**Secondary containment should be designed and constructed to prevent the ingress of surface and ground water.** Preventing water ingress will reduce the frequency of water alarms from sensors in the secondary containment. It will also help reduce the tendency of facility operators to raise their sensors to avoid water alarms, and would reduce the amount of water that has to be removed from the containment and disposed of properly. Finally, any adverse impact that water may have on sensors (such as corrosion or accelerated failure of internal components) would be minimized by keeping water out of the secondary containment.	Recent legislation (SB 989, Stats. 1999) requires periodic integrity testing of secondary containment. The SWRCB adopted regulations implementing this requirement in May, 2001.
2	**Secondary containment should be tested periodically.** Testing will verify that the containment is capable of holding product in the event of a release. Testing will also identify points where groundwater may enter the containment. Once identified, these points can be repaired in order to prevent groundwater intrusion into the secondary containment.	Recent legislation (SB 989, Stats. 1999) requires periodic integrity testing of secondary containment. The SWRCB adopted regulations implementing this requirement in May, 2001.
Oversight and Qualifications		
1	**UST operators should be trained about their role in effective leak prevention.** The most common problem observed in this field evaluation was raised sensors. In many of these cases it is likely that the facility operator raised the sensor in order to disable it, or to take it out of alarm when liquid was in the secondary containment. Tampering with leak detection is a regulatory violation, and individuals caught doing so may be subject to penalties and fines. Raising sensors makes the leak detection system less effective, thus increasing the risk of release of hazardous substances to the environment. Training UST owners and operators on proper alarm response and the consequences of tampering with monitoring equipment will help reduce this problem.	Recent legislation (SB 989, Stats. 1999) requires that all UST operators meet minimum industry-established training standards. SWRCB UST program staff have drafted proposed regulations implementing this requirement.
2	**Enforcement action should be taken against those who intentionally hinder the effectiveness of leak detection equipment.** This includes tampering with sensors, ignoring alarms, turning off monitoring systems, or failing to take action when product or water is present within secondary containment. Enforcement action may also be appropriate for other violations that increase the risk of release to the environment, such as tampering with overfill prevention equipment	Recent legislation proposed by the SRWCB (AB 2481, Stats 2002) establishes an administrative enforcement authority, making it easier for local regulatory agencies to pursue enforcement action.
3	**UST inspectors would benefit from additional training on the limitations and proper application of sensors.** Some sensors were installed incorrectly for the specific conditions at a particular UST facility. Facility-specific conditions included the type of product stored and the size or shape of the monitored space. By better understanding how each type of sensor operates, regulators can make more informed decisions about the appropriate application and placement of specific sensors when reviewing and approving monitoring plans.	Recent legislation (SB 989, Stats. 1999) requires that all UST inspectors meet minimum industry-established training standards. SWRCB UST program staff have drafted proposed regulations implementing this requirement.

Sensor Field-Certification and Testing Procedures		
1	**All sensors should be functionally tested at least annually.** This annual testing should include under-dispenser containment boxes with mechanical floats and chains (i.e. Bravo Boxes). Testing procedures should also include verification of alarms and pump shutdown where applicable. Monitoring systems that provide shutdown of the pumping system when sensors are disconnected and/or when the monitoring system loses power should also be functionally tested.	Recent legislation (SB 989, Stats. 1999) and corresponding regulations have formalized the requirement that a qualified technician certify all monitoring equipment annually.
2	**Testing should be conducted by a qualified service person.** Service technicians should be knowledgeable about UST monitoring systems, and should be trained the manufacturers of the equipment they are working with. Periodic testing should verify functionality of the sensor, and should be conducted in accordance with the manufacturer's recommended protocols, in a manner consistent with all applicable regulations.	Recent legislation (SB 989, Stats. 1999) requires that all service technicians meet minimum industry-established training standards. SWRCB UST program staff have drafted proposed regulations implementing this requirement, which would be in addition to the existing requirements for a contractor's license and manufacturer's training.
3	**A standard field test procedure should be developed for each sensor technology.** The procedures should demonstrate each sensor's ability to reliably detect a leak (for example, float switch sensors should be tested in liquid rather than by flipping). Manufacturers should work with technicians and regulators to develop these testing procedures, and should train service technicians to perform the testing properly. Technicians should be required to conduct testing in accordance with standard procedures once such procedures are in place.	SWRCB UST program staff plan to work with local regulators, service technicians, and sensor manufacturers to develop appropriate test procedures.
Maintenance and Programming		
1	**Secondary containment should be inspected frequently to verify that it is clean and free of liquid (water and product) and debris.** This field evaluation showed that, due to a variety of factors, sensors were not 100% effective at detecting liquid in secondary containment. Therefore, it is important to perform frequent visual inspection of these areas. We recommend that visual inspections be conducted on at least a monthly basis.	SWRCB UST program staff have drafted a proposed regulatory change requiring monthly visual inspection of each UST facility (including secondary containment) by a certified UST operator.
2	**Float sensors should be inspected frequently (more than once a year) to verify that they are functional.** Float sensors may not work properly if debris and dirt within the secondary containment interferes with the movement of the float mechanism. In order to have effective monitoring of secondary containment using float sensors, frequent inspections and maintenance is important. This recommendation is particularly significant given the prevalence of float sensors (68% of sensors in this field evaluation).	SWRCB UST program staff have drafted a proposed regulatory change requiring monthly visual inspection of each UST facility (including secondary containment) by a certified UST operator.
3	**Sensors installed in piping sumps to monitor pressurized piping should be programmed to shut down the pump when product is detected.** Most monitoring systems are capable of this function if they are programmed accordingly. Programming the monitoring system to shut down the pump when a leak is detected in the piping is a simple, inexpensive way to reduce the risk of release of hazardous substances to the environment.	SWRCB UST program staff have drafted a proposed regulatory change that will encourage this type of programming by establishing it as a cost-saving equivalent to annual tightness testing of double-walled piping.

Discriminating Sensors		
1	**Veeder-Root model 794380-341 sensors should not be used as discriminating sensors.** The field testing demonstrated they are unable to discriminate between water and product nearly half of the time. However, they were able to reliably determine the presence of liquid. Therefore, all alarms from the model 794380-341 sensors, whether water or product, should be treated identically. Consoles should be programmed accordingly, and Veeder-Root has issued a statement to this effect. We further recommend that all model 794380-341 sensors that fail the annual monitoring certification be replaced with a different model.	SWRCB UST program staff worked with Veeder-Root staff to field-test the model 794380-341. As a result of the poor reliability demonstrated in this testing, Veeder-Root has agreed to discontinue marketing of this model. They have also re-programmed all model 794380-341 sensors in the field to function as non-discriminating.
2	**Discriminating sensors should be tested in water and product as part of the annual monitoring certification.** Since discriminating sensors are programmed to respond differently in product than in water, and since different alarms may receive different responses from on-site staff, it is important to verify that the water and product detection capabilities of the sensor are functional. If long response and recovery times make such testing impracticable, the use of a different type of sensor should be considered.	SWRCB UST program staff are developing guidance for local regulatory agencies. The guidance will address proper application and testing of discriminating sensors.
3	**A new evaluation protocol should be developed to effectively evaluate polymer strip sensors under field-representative conditions that may impact their performance.** The protocol should assess the sensor's ability to respond to hydrocarbons in a variety of environmental conditions, and the impact that repeated/prolonged exposure to product may have on the sensor's ability to alarm and recover from alarm reliably. Since current evaluation protocols do not cover these key performance factors, no new polymer strip sensors should be installed until new evaluation protocols are in place and the sensors have been certified in accordance with those protocols.	SWRCB UST program staff have worked with the National Workgroup on Leak Detection Evaluation (NWGLDE), which reviews third-party evaluations of leak detection equipment. We will continue to work with the NWGLDE, USEPA, and other state UST programs to improve the evaluation process.
4	**Water alarms from point liquid discriminating sensors should receive a rapid response.** Since point liquid discriminating sensors can only respond to the liquid directly in contact with the detection element, they are unable to detect a product release floating on an existing pool of water whose height exceeds the level of the detection element. To minimize the risk of missed product detection with these sensors, it is important that water alarms be responded to promptly and owners and operators be trained on the limitations of these type of discriminating sensors. Regulatory agencies should consider the limitations of these sensors when reviewing monitoring plans.	SWRCB UST program staff are developing guidance for local regulatory agencies. The guidance will address proper application and testing of discriminating sensors.
5	**When installed in turbine sumps and UDC, polymer strip discriminating sensors with low and high level liquid alarms should activate pump shutdown for both product and high-level liquid alarm.** Once the water level has risen above the high-level float, floating product will not come in contact with the polymer cable or strip. There is essentially no leak detection once water reaches the high-level float, so all sensors of this type which are monitoring pressurized piping should be programmed to shutdown the pump at high liquid level. Proper console configuration and operation of the pump shutdown feature should be verified during the annual monitoring certification.	SWRCB UST program staff are developing guidance for local regulatory agencies. The guidance will address proper application and testing of discriminating sensors.

6	**Longer response times associated with polymer strip discriminating sensors may make them inappropriate for use in certain applications**. Polymer strip discriminating sensors are much slower to respond to hydrocarbons than other sensor types. Therefore, care must be taken when considering their use. Polymer strip discriminating sensors should not be used as the sole monitoring method for double-walled pressurized piping unless they are programmed to shut down the pump when exposed to water or product.	SWRCB UST program staff are developing guidance for local regulatory agencies. The guidance will address proper application and testing of discriminating sensors.
7	**Polymer strip discriminating sensors should not be used in UST systems storing diesel.** Since diesel fuel is not as volatile as unleaded fuel, polymer strips respond much more slowly (response times in diesel fuel may be 12 hours or more.) The lengthy response time of polymer-strip sensors in diesel fuel poses an increased risk of release to the environment.	SWRCB UST program staff are developing guidance for local regulatory agencies. The guidance will address proper application and testing of discriminating sensors.
8	**Monitoring plans for facilities with discriminating sensors should include response plans for both water and product alarms.** Leaving water in the secondary containment for an extended time period is unacceptable. The most appropriate solution for dealing with water in the secondary containment is to make the containment systems water tight. California's program of periodic integrity testing of secondary containment systems should help minimize water intrusion problems, by identifying and repairing leaks through which groundwater may enter. Regulatory agencies should review response plans to assure that response times for water and product alarms are appropriate based on facility-specific conditions.	SWRCB UST program staff are developing guidance for local regulatory agencies. The guidance will address proper application and testing of discriminating sensors.
9	**Discriminating sensors may be reprogrammed as non-discriminating if needed.** In response to the recommendations of this report, or to comply with local ordinances, UST operators may wish to replace their discriminating sensors with a non-discriminating model. As an alternative to replacement, many discriminating sensors can be reprogrammed to operate as non-discriminating. Reprogramming can be a cost-effective solution for discriminating sensors that may not be providing effective leak detection or satisfying local ordinances. Note that only a representative authorized by the manufacturer should perform this reprogramming.	SWRCB UST program staff are developing guidance for local regulatory agencies. The guidance will address proper application and testing of discriminating sensors.